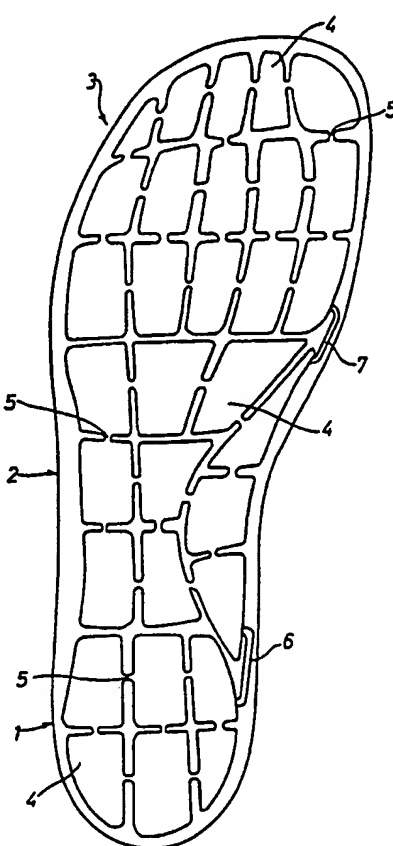


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<p>(21) International Application Number: PCT/DK88/00008 (22) International Filing Date: 19 January 1988 (19.01.88) (71) Applicant (for all designated States except US): CEL- LASTIC A/S [DK/DK]; Fredericiagade 16, DK-1310 København K (DK). (72) Inventors; and (75) Inventors/Applicants (for US only) : HESSEL, Lasse [DK/GB]; Oakley Hill, Bridle Way, Goring-on- Thames, Reading RG8 0HS (GB). BECKETT, Chris- tian [DK/DK]; Odinsvej 17B, DK-3140 Ålsgård (DK). (74) Agent: LEHMANN & REE; Frederiksberg Allé 26, DK-1820 Frederiksberg C (DK). (81) Designated States: AT (European patent), AU, BE (Eu- ropean patent), BR, CH (European patent), DE (Eu- ropean patent), DK, FI, FR (European patent), GB (European patent), IT (European patent),</p>		<p>JP, KR, LU (European patent), NL (European pa- tent), NO, SE (European patent), US. Published <i>With international search report. In English translation (filed in Danish).</i></p>
<p>(54) Title: FOOTWEAR SOLE</p> <p>(57) Abstract</p> <p>Footwear sole comprising a heel, an arch and a toe portion (1, 2, 3) each comprising a separate system of liquid-filled compartments (4) interconnected by flow-inhibiting passages (5) the system of liquid-filled compartments (4) in the toe portion (3) as well as the system of liquid-filled compartments (4) in the heel portion (1) being connected to the system of liquid-filled compartments (4) in the arch portion (2) through passages (7, 6) which produce a higher resistance to liquid flow towards the arch portion (2) than away from same. The footwear sole offers particularly good walking comfort.</p> 		

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Footwear sole

This invention relates to a footwear sole and in particular a shoe sole, which sole comprises a system of liquid-filled compartments interconnected by flow-inhibiting passages.

Patent publication No. EP-170947-A1 describes a resilient support comprising a system of liquid-filled passages of the above-mentioned kind, and in said patent publication it is mentioned that such a support is suitable for shoe soles.

During the practical embodiment of a footwear sole based on such a system of interconnected liquid-filled compartments it has been found that a surprisingly good walking comfort is obtained with a footwear sole which is characterized in that the heel, arch and toe portions of the footwear sole each comprises a separate system of liquid-filled compartments interconnected by flow-inhibiting passages and that the system of liquid-filled compartments in the toe portion as well as the system of liquid-filled compartments in the heel portion are connected to the system of liquid-filled compartments in the arch portion through passages which are adapted so as to produce a higher resistance to liquid flow towards the arch portion than away from same.

The present invention is based on the discovery that the heel and toe portion of a footwear sole are exposed to heavier load during walking than the arch portion, and that in order to prevent stepping through in the two first-mentioned portions of the sole it is necessary to establish a higher degree of liquid flow resistance from the toe or the heel portion towards the arch portion than in the opposite direction, and that the liquid flow in the latter direction should be as high as possible in order to allow the amount of liquid in e.g. the heel portion to be restored rapidly, when the load on the heel portion is relieved and is transferred to the toe portion through the arch portion. The same applies, when the load on the toe portion is relieved and transferred to the heel portion.

The passage between the heel or toe and arch portions, respectively, is preferably provided at the edge of the sole and preferably it

comprises a valve producing said asymmetric flow resistance. Valves of this kind are well known in the art.

5 Owing to its simple construction and to its considerable sturdiness a particularly preferred valve consists of a bar-shaped body to which are attached radially radiating soft brushes which are longer than the radius of the passage, the free ends of the brush pointing away from the arch portion of the sole.

10 By placing such a valve in each of the two said passages the brushes spread out when the pressure in the toe portion or on the heel portion increases, thus increasing the resistance to liquid flow towards the arch portion. However, when the pressure in the arch portion is caused to exceed the pressure in the heel portion or the
15 toe portion the brushes are pressed against the bar-shaped body and in this position they produce only limited resistance to the liquid flow through the passages in question.

20 Preferably, the liquid in the compartments have a higher viscosity than water, but the compartments may also contain pure water or aqueous media of substantially the same viscosity as water. When a relatively viscous liquid is used in said compartments it preferably consists of 80% water and 20% propylene glycol.

25 The invention will now be described more in detail with reference to the accompanying drawing, wherein:

Figure 1 is a horizontal-sectional view through a shoe sole according to the invention,
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Figure 2 is an axial-sectional view through a passage connecting the heel portion with the arch portion in the shoe sole shown in Figure 1, and with a valve located within the passage,

35 Figure 3 is a cross-sectional view of the passage shown in Figure 2 equipped with a valve under liquid flow from the arch portion towards the heel portion, and

Figure 4 is a cross-sectional view of the passage shown in Figure 2.

equipped with a valve under liquid flow from heel portion towards the arch portion.

5 The shoe sole shown in Figure 1 comprises a heel portion 1, an arch portion 2 and a toe portion 3. Each of these portions comprises a number of liquid-filled compartments 4 which are interconnected by narrow passages 5. The liquid-filled compartments 4 of the heel portion 1 are connected to the liquid-filled compartments 4 of the arch portion 2 through a passage 6 located at the edge of the sole. 10 Similarly, the liquid-filled compartments 4 of the toe portion 3 are connected to the liquid-filled compartments 4 of the arch portion 2 through a further passage 7. Passages 6 and 7 are equipped with valves (not shown), which produce a considerably higher resistance to the liquid flow away from the heel portion or the toe portion 15 than from the arch portion towards the heel or toe portion.

The valve shown in Figures 2-4 consists of a bar-shaped body 10 placed centrally in the passage 6 and having fixed thereto a large number of radially radiating soft brushes 11 which are longer than 20 the radius of the passage and with the brushes pointing towards the heel portion.

Figure 3 shows the position of the brushes during flow of liquid from the arch portion 2 towards the heel portion 1 and Figure 4 the 25 position of brushes during liquid flow in the opposite direction. As will appear by comparing Figures 3 and 4, the brushes produce a much higher resistance to flow towards the arch portion 2 than away from same.

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C l a i m s

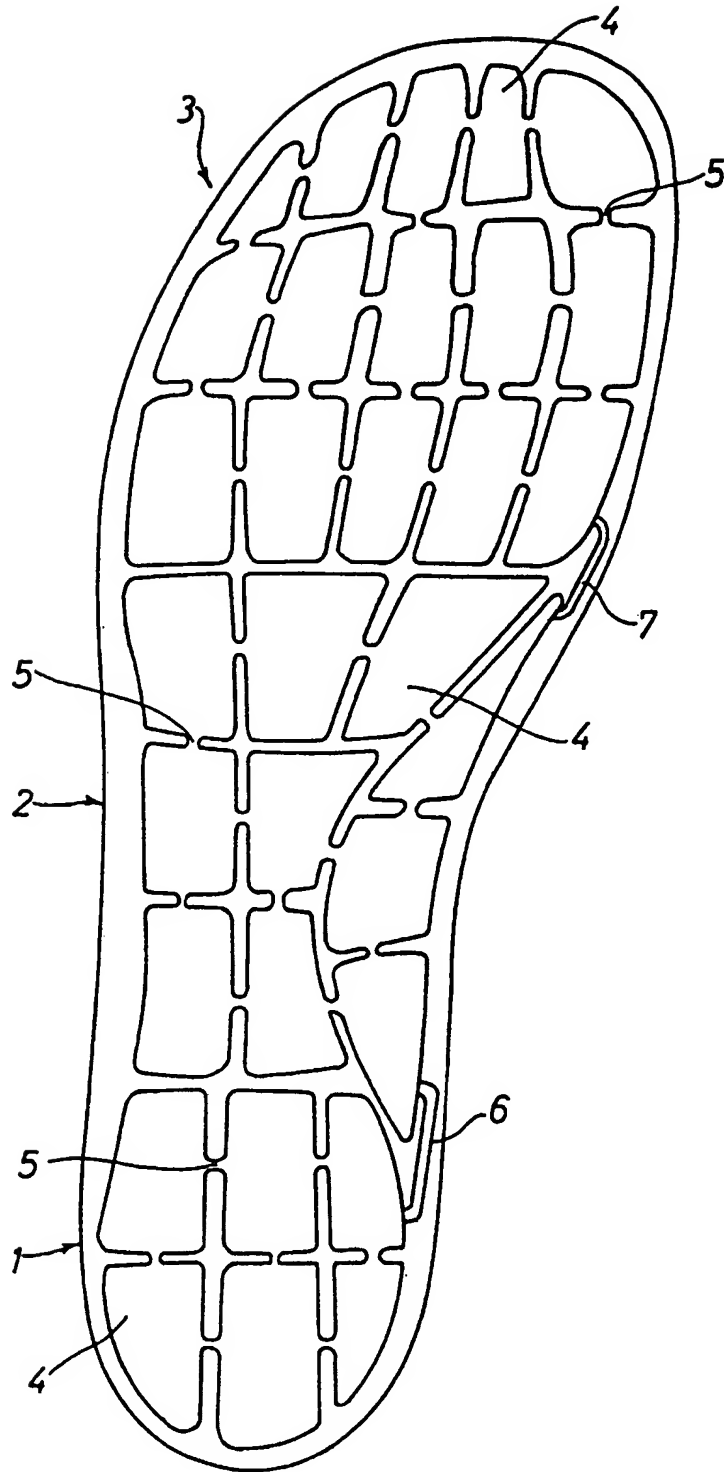
1. A footwear sole comprising of a system of liquid-filled compartments interconnected by flow-inhibiting passages, c h a r -
5 a c t e r i z e d in that the heel, arch and toe portions of the footwear sole each comprises a separate system of liquid-filled compartments interconnected by flow-inhibiting passages and that the system of liquid-filled compartments in the toe portion as well as
10 the system of liquid-filled compartments in the heel portion are connected to the system of liquid-filled compartments in the arch portion through passages which are adapted so as to produce higher resistance to liquid flow towards the arch portion than away from same.
- 15 2. A footwear sole according to Claim 1, c h a r a c t e r i z e d in that the passage between heel portion and toe portion, respectively, and the arch portion is located at the edge of the sole.
- 20 3. A footwear sole according to Claims 1 or 2, c h a r a c t e r - i z e d in that the passage between heel portion and toe portion, respectively, and the arch portion is equipped with a valve consisting of an axially extending bar-shaped body having attached thereto a plurality of soft brushes which are longer than the radius of the passage, the free ends of the brushes pointing away from the
25 arch portion of the sole.

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1/2

Fig.1



2/2

Fig.2

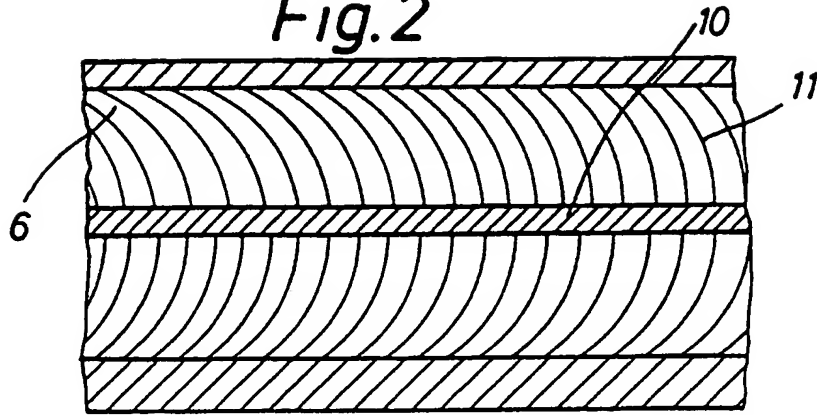


Fig.3

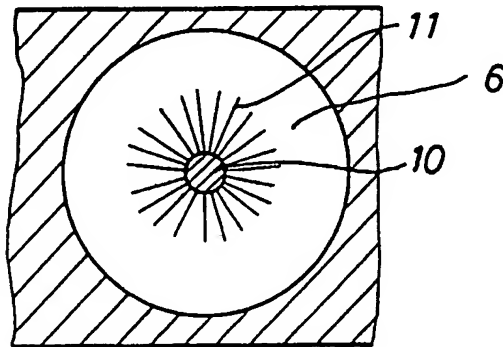
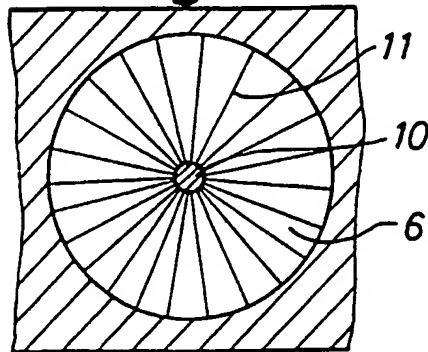


Fig.4



INTERNATIONAL SEARCH REPORT

PCT/DK88/00008

International Application No

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) *		
According to International Patent Classification (IPC) or to both National Classification and IPC 4		
A 43 B 13/40 // A 43 B 13/20		
II. FIELDS SEARCHED		
Minimum Documentation Searched 7		
Classification System	Classification Symbols	
IPC 4	A 43 B 13/18, /20, /40, 17/02, /03; A 47 C 27/08	
Nat C1	71a:13/18, /10, /40, 17/02	
US C1	5:450, 451; 36:28, 29, 35, 43	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched *		
SE, NO, DK, FI classes as above		
III. DOCUMENTS CONSIDERED TO BE RELEVANT 8		
Category 9	Citation of Document, 11 with indication, where appropriate, of the relevant passages 12	Relevant to Claim No. 13
A	US, A, 1 148 376 (SAMUEL S. GAY) 27 July 1915	1
A	US, A, 3 795 994 (AVA) 12 March 1974	1
A	EP, A2, 0 062 622 (PETERSON LARS GUSTAF BIRGER) 13 October 1982	1
A	GB, A, 2 073 006 (THE ENERGY SHOE COMPANY) 14 October 1981	1
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IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
1988-04-21	1988-04-25	
International Searching Authority	Signature of Authorized Officer	
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